BUREAU OF WATER

South Carolina Department of Health and Environmental Control

SHELLFISH MANAGEMENT AREA 9A

2006 ANNUAL UPDATE

Shellfish Sanitation Program

Water Monitoring, Assessment and Protection Division
Environmental Quality Control - Bureau of Water
2600 Bull Street
Columbia, South Carolina 29201

July 2006

D H E C

PROMOTE PROTECT PROSPER

South Carolina Department of Health and Environmental Control

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2006 ANNUAL UPDATE

[Data Thru December 2005]

Shellfish Management Area 9A
Shellfish Sanitation Program

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South Carolina Department of Health and Environmental Control

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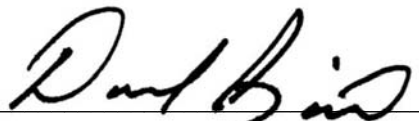

David G. Baize, Division Director
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Environmental Quality Control - Bureau of Water

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Data Inclusive Dates:
01 / 01 / 03 thru 12 / 31 / 05

Classification Change:
X Yes ___ No

Shoreline Survey Completed: Yes

Prior Report & Date: Annual -2005

(I)ncreased/(D)ecreased/(N)one:
I Approved
D Conditionally Approved
D Restricted
N Prohibited

SUMMARY

Shellfish growing area water quality in Area 09A continues to fluctuate. Annual water quality oscillations, primarily rainfall-induced, frequently result in shifts between Approved and Restricted classifications at several Area 09A water quality monitoring stations. For the current three-year review period, three of thirty-three active shellfish monitoring stations exceed Approved area water quality criteria. Based upon the bacteriological water quality analysis and the shoreline pollution source survey, changes will be made to the existing 2005 classification. The Conditionally Approved area adjacent to the Mt. Pleasant mainland will be reclassified as Approved. Additionally, Sullivans Island Narrows, Lofton Creek, portions of southern Conch Creek, and portions of the AIWW between Station 36 and Station 09 (Ben Sawyer Bridge) will be reclassified as Approved.

In order to conserve regional resources, stations 9A-12, 9A-15, 9A-21, and 9A-22 will be deactivated. Due to their close proximity to Breach Inlet and the resulting flushing from coastal ocean waters, the stations have historically met Approved area water quality criteria. Neighboring stations 9A-07, 9A-37, and 9A-14 will continue to be sampled to monitor any changes in water quality.

INTRODUCTION

PURPOSE AND SCOPE

The authority to regulate the harvest, sanitation, processing and handling of shellfish is granted to the South Carolina Department of Health and Environmental Control by Section 44-1-140 of the Code of Laws of South Carolina, 1976, as amended. The Department promulgated Regulation 61-47, which provides the rules used to implement this authority and outlines the requirements applied in regulating shellfish sanitation in the State. This regulation specifically addresses classification of shellfish harvesting areas and requires that all areas be examined by sanitary and bacteriological surveys and classified into an appropriate shellfish harvesting classification.

The United States Food and Drug Administration (USFDA) uses The National Shellfish Sanitation Program's (NSSP) *Guide for the Control of Molluscan Shellfish* to evaluate state shellfish

sanitation programs. The NSSP Model Ordinance requires that a sanitary survey be in place for each growing area prior to its use as a source of shellfish for human consumption and prior to the area's classification as Approved, Conditionally Approved, Restricted, or Conditionally Restricted. Each sanitary survey shall be updated on an annual basis and accurately reflect changes which have occurred within the area. Requirement of the annual reevaluation include, at a minimum, field observations of pollution sources, an analysis of water quality data consisting of the past year's data in combination with appropriate previously collected data, review of reports and effluent samples from pollution sources, and review of performance standards for discharges impacting the growing area. A brief report documenting the findings shall also be provided.

The following criteria consistent with the NSSP Model Ordinance and S. C. Regulation 61-47 are used in establishing shellfish harvesting classifications:

Approved - Growing areas shall be classified Approved when the sanitary survey concludes that fecal material, pathogenic microorganisms, and poisonous or deleterious substances are not present in concentrations which would render shellfish unsafe for human consumption. The Approved area classification shall be designated based upon a sanitary survey, which includes water samples collected from stations in the designated area adjacent to actual or potential sources of pollution. For waters sampled under adverse pollution conditions, the median fecal coliform Most Probable Number (MPN) or the geometric mean MPN shall not exceed fourteen per one hundred milliliters, and not more than ten percent of the samples shall exceed a fecal coliform MPN of forty-three per one hundred milliliters (per five tube decimal dilution). For waters sampled under a systematic random sampling plan, the geometric mean fecal coliform Most Probable Number (MPN) shall not exceed fourteen per one hundred milliliters, and the estimated ninetieth percentile shall not exceed an MPN of forty three (per five tube decimal dilution). Computation of the estimated ninetieth percentile shall be obtained using NSSP Guidelines.

Conditionally Approved - Growing areas may be classified Conditionally Approved when they are subject to temporary conditions of actual or potential pollution. When such events are predictable, as in the malfunction of wastewater treatment facilities, non-point source pollution from rainfall runoff, discharge of a major river, or potential discharges from dock or harbor facilities that may affect water quality, a management plan describing conditions under which harvesting will be allowed shall be adopted by the Department prior to classifying an area as Conditionally Approved. Where appropriate, the management plan for each Conditionally Approved area shall include performance standards for sources of controllable pollution, e.g., wastewater treatment and collection systems, evaluation of each source of pollution, and means of rapidly closing and subsequent reopening areas to shellfish harvesting. Memorandums of agreements shall be a part of these management plans where appropriate.

Restricted - Growing areas shall be classified Restricted when sanitary survey data show a limited degree of pollution or the presence of deleterious or poisonous substances to a degree which may cause the water quality to fluctuate unpredictably or at such a frequency that a Conditionally Approved classification is not feasible. Shellfish may be harvested from areas classified as Restricted only for the purposes of relaying or depuration and only by special permit issued by the Department and under Department supervision. For Restricted areas to be utilized as a source of shellstock for depuration, or as source water for depuration, the fecal coliform geometric mean MPN of restricted waters sampled under adverse pollution conditions shall not exceed eighty-eight per one hundred milliliters and not more than ten percent of the samples shall exceed a MPN of two hundred

and sixty per one hundred milliliters for a five tube decimal dilution test. For waters sampled under a systematic random sampling plan, the fecal coliform geometric mean MPN shall not exceed eighty-eight per one hundred milliliters and the estimated ninetieth percentile shall not exceed an MPN of two hundred and sixty (five tube decimal dilution). Computation of the estimated ninetieth percentile shall be obtained using NSSP guidelines.

Conditionally Restricted - Growing areas may be classified Conditionally Restricted when they are subject to temporary conditions of actual or potential pollution. When such events are predictable, as in the malfunction of wastewater treatment facilities, non-point source pollution from rainfall runoff, discharge of a major river, or potential discharges from dock or harbor facilities that may affect water quality, a management plan describing conditions under which harvesting will be allowed shall be prepared by the Department prior to classifying an area as Conditionally Restricted. Where appropriate, the management plan for each Conditionally Restricted area shall include performance standards for sources of controllable pollution (e.g., wastewater treatment and collection systems and an evaluation of each source of pollution) and description of the means of rapidly closing and subsequent reopening of areas to shellfish harvesting. Memorandums of agreements shall be a part of these management plans where appropriate. Shellfish may be harvested from areas classified as Conditionally Restricted only for the purposes of relaying or depuration and only by permit issued by the Department and under Department supervision. For Conditionally Restricted areas to be utilized as a source of shellstock for depuration, the fecal coliform geometric mean MPN of Conditionally Restricted waters sampled under adverse pollution conditions shall not exceed eighty-eight per one hundred milliliters and not more than ten percent of the samples shall exceed a MPN of two hundred and sixty per one hundred milliliters for a five tube decimal dilution test. For waters sampled under a systematic random sampling plan, the fecal coliform geometric mean MPN shall not exceed eighty-eight per one hundred milliliters and the estimated ninetieth percentile shall not exceed an MPN of two hundred and sixty (five tube decimal dilution). Computation of the estimated ninetieth percentile shall be obtained using NSSP guidelines.

Prohibited - Growing areas are classified Prohibited if there is no current sanitary survey or if the sanitary survey or monitoring data show unsafe levels of fecal material, pathogenic microorganisms, or poisonous or deleterious substances in the growing area or indicate that such substances could potentially reach quantities which could render shellfish unfit or unsafe for human consumption.

BACKGROUND INFORMATION

This sanitary survey evaluates the current harvesting classification of shellfish growing waters designated as Shellfish Management Area 09A (Area 09A). Area 09A consists of approximately 7,044 acres of shellfish growing area habitat located in Charleston County, South Carolina. The area consists of the Atlantic Intracoastal Waterway (AIWW) and four primary creeks: Conch, Hamlin, Inlet and Swinton. Area 09A extends in a generally northeast to southwest direction, from approximately one quarter mile south of Morgan Creek, to the Charleston Harbor. The northern boundary is an imaginary line extending from 41st Avenue on the Isle of Palms, through Gray Bay, to the Mount Pleasant mainland near Six Mile Road. US Highway 17 defines the area's western boundary. The southern boundary is the Charleston Harbor. The eastern boundary consists of the Atlantic Ocean shoreline of the Isle of Palms and Sullivan's Island.

The harvesting classifications of Area 09A prior to this sanitary survey were as follows:

Prohibited: (Administrative closure)

1. The AIWW, extending approximately 1000 feet from the Forest Trail outfall (Area 08);
2. Hamlin Creek, the full width of the creek extending approximately 1565 ft to the north and 939 feet to the south of Two Island Marina/Long Island Yacht Harbor (this represents an adjustment to the 2003 closure zone and is based upon modeling dated 03/15/2002);
3. The Cove, along Sullivan's Island, between Charleston Harbor and the Ben Sawyer Bridge (Station 09).

Restricted:

1. The AIWW, from the administrative closure at Station 18 southwest to Station 19;
2. The AIWW, from Station 36 southwest to Station 09;
3. Sullivan's Island Narrows, from the Ben Sawyer Bridge to Station 17A, including all adjacent marshlands to the south;
4. Conch Creek, from Station 36 southeastward to Station 20, including all adjacent marshlands to the south;
5. Lofton Creek, from its confluence with Conch Creek at Station 20 to its headwaters.
6. Inlet Creek and vicinity, from Station 24 southward to a point approximately 700 feet south of Station 31, including all marshlands landward of this line to the Mount Pleasant mainland.

Conditionally Approved:

1. Those waters of Swinton Creek from Station 03, through Station 25, extending approximately 5500 feet in a northeasterly direction and including all adjacent marshlands north and west of this line to the upland shores of Area 9A.

Approved: All other waters of Area 09A.

The shellfish industry in South Carolina is based primarily on the harvest of the eastern oyster (*Crassostrea virginica*) and hard clams, which include both the northern clam (*Mercenaria mercenaria*) and several small populations of the southern clam (*Mercenaria campechiensis*). Areas in South Carolina designated for commercial harvest by the South Carolina Department of Natural Resources (SCDNR) include State shellfish grounds, culture permits, and Kings Grant areas. Recreational harvesters in South Carolina also harvest the ribbed mussel, *Geukensia demissa*, on a small scale.

There are two State Shellfish Grounds (S) within Area 09A: S-251 and S-255. Additionally, two Recreational Shellfish Grounds (R) are located in Area 09A: R-234 encompasses Gray Bay, while R-252 consists of upper Hamlin Creek and its adjacent marshland. One King's Grant (G) is located in Area 9A between Conch and Inlet Creeks bisected by the AIWW. There are numerous Culture Permit (C) and Mariculture Permit (M) leases throughout the area.

The shellfish harvest season in South Carolina normally extends from mid-September through mid-May. The South Carolina Department of Natural Resources (SCDNR) has the authority to alter the shellfish harvest season for resource management purposes and grant permits for year-round mariculture operations. Additionally, the South Carolina Department of Health and Environmental Control has the authority to prohibit shellfish harvesting when necessary to ensure that shellfish harvested in South Carolina waters are safe for human consumption.

POLLUTION SOURCE SURVEY

CHANGES IN POLLUTION SOURCES

No substantial changes in pollution sources have occurred in Area 09A since the 2005 report.

SURVEY PROCEDURES

Shoreline surveys of Area 09A were conducted by the Trident District Shellfish Sanitation staff, by watercraft, vehicle and on foot during the survey period and are ongoing. Extensive visual examinations of lands adjacent to the waters of Area 09A were conducted to determine potential sources of pollution entering shellfish growing waters.

Thermal Imaging

The Department recently funded a pilot project to determine the effectiveness of Forward Looking Infrared Radar (FLIR) in locating sources of pollution in close proximity to coastal shellfish harvest areas. FLIR is a type of thermal infrared imaging that can help locate contaminated "seeps" by detecting differences in water temperature, thereby providing coastal managers with smaller focus areas from which to obtain water samples and conduct shoreline survey investigations.

Regional Shellfish Program personnel prioritized study areas based upon shellfish area closures due to elevated fecal coliform levels - potentially from failing septic systems. Nighttime surveillance flights were conducted during February 2005, when relatively warm discharges from potential pollution sources such as leaking septic systems would contrast in comparison with colder river/creek surface waters. Flying during the winter also minimized interference from vegetation.

Based on thermal imagery data obtained through aerial surveillance, Region 7 Shellfish Program staff investigated potential pollution sources and, when appropriate, conducted bacteriological water quality analysis during the spring and summer of 2005. Sample locations and results of site investigations are provided in appropriate sections of this report.

POINT SOURCE POLLUTION

National Pollutant Discharge Elimination System (NPDES) Permitted Facilities		
Permit Number	**Facility Name**	**Facility Type**
SC0020052-001	Sullivan's Island WWTF	Municipal-Discharge
SC0040771-004	Mt. Pleasant Waterworks WWTF	Municipal-Spray Irrigation
SC0040771-005	Mt. Pleasant Waterworks WWTF	Municipal-Spray Irrigation
SC0043583-001	Isle of Palms W&S - R/O	Municipal-Discharge
SC0040771-006	Mt. Pleasant WW/WTR TTMT	Municipal-Discharge

SC0025283-002	Isle of Palms – Forest Trails/SD	Municipal-Discharge

A. Municipal and Community Waste Treatment Facilities – The Mount Pleasant Waterworks operates two facilities within Area 9A, one located on Rifle Range Road and the other located on Center Street. Neither of these facilities discharge to Area 9A waters. The Sullivan's Island Wastewater Treatment Plant discharges near Cove Creek, adjacent to Ben Sawyer Boulevard. The Forest Trail Wastewater Treatment Plant is located within Shellfish Management Area 08 on the Isle of Palms. The facility discharges treated effluent into the AIWW adjacent to 41st Avenue near the northern boundary of Area 9A. A 1000-foot minimum closure is located around all wastewater outfalls. Additionally, the Isle of Palms and the Mount Pleasant Waterworks both operate water treatment plants within the area. Both facilities ultimately discharge into Area 09A, however, there is no fecal coliform component associated with the effluents. Refer to the Potential Pollution Sources map included in this report.

There were no reported wastewater overflows that entered the growing waters of Area 9A in 2005. Available hydrographic information suggests a possible impact from sources located outside the growing area. The area from the Charleston Harbor extending northeast to the Ben Sawyer Bridge appears to be impacted during certain hydrographic conditions by waters originating in the Charleston Harbor (Cleveland, 1967). Effluent from wastewater treatment plants discharging into the harbor may be impacting extreme southwestern portions of Area 09A. Flow calculations have established time and distance of travel and place the effluent plumes within the Cove at Sullivan's Island. Due to public health concerns, southwestern portions of Area 9A from Ben Sawyer Boulevard to the Charleston Harbor will remain Administratively Prohibited.

B. Industrial Waste (Discharges) - Currently there are no operational industrial wastewater discharges located within the boundaries of Area 09A.

C. Marinas – S.C. Regulation 61-47, Shellfish defines *Marina* as "any water area with a structure (docks, basin, floating docks, etc.), which is: 1) used for docking or otherwise mooring vessels; and, 2) constructed to provide temporary or permanent docking space for more than ten boats, or has more than 200 linear feet of docking space." There are three recreational facilities located within this management area. Two of facilities, Two Island Marina (Isle of Palms Marina) and Long Island Yacht Harbor, are located adjacent to Breach Inlet. Combined, these two marinas typically accommodate approximately 55 boats. Sewage pump-out facilities are provided at the Long Island Yacht Harbor. Additionally, Toler's Cove is located west of the AIWW, adjacent to the south side of the Ben Sawyer Boulevard. This marina accommodates approximately 40 boats and provides wastewater pump-out to the municipal sewer system. There are no commercial docking facilities meeting the definition of a marina within Area 09A.

D. Radionuclides - Sources of radionuclides have not been identified within Area 09A, and radionuclide monitoring has not been conducted. No other sources of poisonous or deleterious substances have been identified within the area.

NONPOINT SOURCE POLLUTION

A. Urban and Suburban Stormwater Runoff - The shoreline survey conducted in Area 09A revealed a high concentration of homes throughout most uplands adjacent to the shellfish growing area. Single-family homes continue to be built along the mainland shores. New homes are currently under construction on Goat Island (adjacent to station 18), in lower Hamlin Creek (adjacent to station 11) and in Toler's Cove. Additionally, a new housing complex is under construction near Station 25. Stormwater runoff may adversely impact shellfish water quality by transporting fecal coliform bacteria from land to the shellfish growing area.

There are approximately 201 stormwater permits that have been issued within Charleston County for 2005. These permits are included as an indicator of land disturbing activities. The permits within Area 09A are distributed throughout the area and have been primarily issued to construction sites and/or housing subdivisions. The remaining permits are for stormwater control for schools, churches and commercial properties. These areas are depicted on the attached Potential Pollution Source map. There are three dredge spoil areas located along the AIWW between Hamlin Creek and Inlet Creek.

The uplands surrounding the shellfish growing waters of Area 09A consist of various soil textures defined by the United States Department of Agriculture (USDA), Soil Conservation Service (1971) utilizing general classifications and descriptions. Although lands within Area 09A consist of numerous soil types, the area is generally comprised of Rutlege-Scranton-Pamlico soils, made up of low, broad flats and long, nearly level, sandy ridges. The area is interlaced with the Chipley series; which is a loamy, fine sand. The USDA (1971) further describes these soils as "somewhat poorly drained to very poorly drained, nearly level to depressional, sandy and mucky soils."

B. Agricultural Runoff - There are no permitted agricultural facilities located in Area 09A. The lack of concentrated agricultural activity near the shoreline of the growing waters precludes contamination of shellfish waters from agricultural runoff.

C. Individual Sewage Treatment and Disposal Systems - Homes adjacent to shellfish growing waters on Isle of Palms and Sullivan's Island are all served by sanitary sewer. Goat Island, located between Isle of Palms and Gray Bay, is served solely by individual septic systems. Cassina Plantation has approximately 33 homes on individual septic systems. This area is near stations 24, 30 and 31 in upper Inlet Creek. Mount Pleasant also has no sewer service from Ravens Run, north to the area border, along Rifle Range Road. However, new sewer lines are being installed into the developed areas and sewer service will soon be offered. Each septic system requires inspection and approval by the Division of Environmental Health, Trident Health District, prior to operation.

Sample Data for Area 9A Aerial Flight

Sample	Longitude	Latitude	Sample Date	Sample Results
SE-6	32.786143	79.854208	May 5, 2005	>160,000

This sample is from an outfall of a storm water ditch that runs through a new subdivision. Mt. Pleasant water works is reviewing as built drawing to try and identify a possible source.				
SE-25	32.780650	79.804447	May 18, 2005	2300
This sample is from an outfall of a storm water ditch that runs from Palm Boulevard. We have this site on our list to watch and try and identify a possible source.				
SE-30	32.782345	79.800011	May 18, 2005	5,000
This sample is from the headwaters of a small tributary that runs along Palm Boulevard. We have this site on our list to watch and try and identify a possible source. A resample of this area produced results slightly above background.				
SE-36-Brg	32.789705	79.788448	May 5, 2005	2300
The site is located under the Isle of Palms connector on the IOP side. This site has multiple storm water discharges that converge under the bridge. We have this site on our list to watch and try and identify a possible source.				
SE-37	32.793224	79.786763	May 5, 2005	4000
The site is located just north of the Isle of Palms connector on the IOP side. There is a storm water discharge that picks up water from the backside of the Isle of Palms. We have this site on our list to watch and try and identify a possible source.				
SE-47	32.765436	79.837608	May 4, 2005	5000
This sample is from an outfall of a storm water ditch that runs along the marsh side of Sullivan's Island. We have this site on our list to watch and try and identify a possible source.				
SE-48-2	32.761467	79.854785	May 4, 2005	160,000
This sample is from an old abandoned storm water outfall that runs along the marsh side of Sullivan's Island. We have this site on our list to watch and have been working with the Town of Sullivan's Island to try and identify the possible source(s). Re-samples taken in this area by Sullivan's Island have been closer to background.				

D. **Wildlife and Domestic Animals** - Area 09A supports a large population of domestic animals attributable to the number of private residences along the shores of Mount Pleasant, Isle of Palms and Sullivan's Island. The area also supports substantial wildlife populations, primarily various types of marine waterfowl typical of coastal South Carolina. The waterfowl are present all year in the area. However, they have been noted to be in higher concentrations during the summer months (June-August).

E. **Boat Traffic** - Recreational boat traffic is heavy in the area throughout the year. Commercial traffic in the AIWW is moderate and consists primarily of tugs and barges. Commercial fisheries boats, primarily shrimpers and crabbers ranging in size from 16 to 50 feet, operate in accordance with seasonal fisheries. During the recreational shrimp-baiting season, typically extending from mid-September through mid-November, recreational traffic is very heavy.

F. **Hydrographic and Habitat Modification** - Hydrographic and habitat modification in estuarine areas requires both State and Federal approval. Portions of the AIWW require maintenance dredging. The U.S. Army Corps of Engineers utilizes designated tracts of land adjacent to the AIWW as dredge spoil sites.

G. **Marine Biotoxins** - Bivalve shellfish contamination from marine biotoxins has not been shown to be a human health concern within Area 09A. The Department participates in a State Task Force on Toxic Algae and maintains a Toxic Algae Emergency Response Team.

HYDROGRAPHIC AND METEOROLOGICAL CHARACTERISTICS

PHYSIOGRAPHY

Area 09A is comprised of tidal creeks, shallow bays and associated tidal marshlands. The creeks within the area range from 20 to 300 feet in width. Maximum depths approach approximately 20 feet. Additionally, the AIWW traverses the area's entire length in a northeasterly-southwesterly direction. The AIWW is maintained at a mean low water depth of 12 feet by the US Army Corps of Engineers. The major conduits of water flowing into and out of the area are; the AIWW on the northeastern border, Breach Inlet, between Sullivans Island and the Isle of Palms which define the eastern extent of the area, and, during low river flow conditions, the Charleston Harbor on the southwestern border. The influence of high-salinity ocean water, entering the area via these inlets, provides high flow and a subsequent flushing action that assists in moderating the affects of rainfall runoff on water quality. The entire area is approximately four miles wide (northwest to southeast) and seven miles long (southwest to northeast).

Tides - Tides in Area 09A are semidiurnal, consisting of two low and two high tides occurring each lunar day. Mean tidal ranges in Hamlin Creek along the Isle of Palms are 5.1 feet during normal tides and 6.7 feet during spring tides. Wind direction and intensity, as well as atmospheric pressure, typically cause variations in predicted tidal ranges.

Rainfall - Precipitation in Area 09A is heaviest during late summer and early autumn. Tropical storms and hurricanes occasionally produce extremely large amounts of rainfall. During winter months heavy rainfall events are uncommon, yet occasional intense thunderstorms associated with rapidly moving low-pressure systems generate heavy rains. Precipitation rarely occurs in the form of snow or ice. Spring weather patterns may be dynamic with associated thunderstorms and severe weather conditions.

The yearly rainfall average for a thirty-year period in Charleston, recorded at the Charleston Airport, is 50.5 inches. The 2004 precipitation total recorded in Mount Pleasant was 53.5 inches.

Winds - Prevailing winds along the central portion of the South Carolina coast are from the south and west during spring and summer and from the north during autumn and winter. Wind speeds are generally less than 15 miles per hour (mph); however, strong weather systems may generate winds in excess of 25 mph. Tropical storms and hurricanes occur occasionally.

RIVER DISCHARGES

Freshwater rivers do not discharge directly into Area 09A. Freshwater influence is primarily due to rainfall, although, during periods of high flow in the Cooper River, brackish water may enter via Charleston Harbor.

WATER QUALITY STUDIES

DESCRIPTION OF THE PROGRAM

The Department currently utilizes a systematic random sampling (SRS) strategy within Area 09A in lieu of sampling under adverse pollution conditions. In order to comply with NSSP guidelines, a minimum of thirty samples are required to be collected and analyzed from each station during the review period. Sampling dates are computer generated prior to the beginning of each quarterly period thereby insuring random selection with respect to tidal stage and weather. Day of week selection criteria is limited to Mondays, Tuesdays and Wednesdays due to shipping requirements and laboratory manpower constraints. Sample schedules are rarely altered.

During July 1998, an updated shellfish water quality data scheduling and collection procedure was formalized. Samples utilized for classification purposes are limited to those samples collected in accordance with the SRS for a 36-month period beginning January 1 and ending December 31. This allows for a maximum of 36 samples per station, yet provides a six-sample "cushion" (above the NSSP required 30 minimum) for broken sample bottles, lab error, breakdowns, etc. This also allows each annual report's water quality data to meet the requirements for the NSSP Triennial Review sampling criteria.

One thousand, one hundred eighty-eight (1188) routine surface water samples (<1.0 ft. deep) were collected for bacteriological analysis and classification purposes from Area 09A shellfish water quality monitoring sites during the period 01/01/03 through12/31/05. The samples were collected from 33 currently active stations in accordance with the Department's SRS plan. Additionally, eighty (80) special bacteriological samples were collected during the review period for non-classification purposes. The samples utilized for this report were collected in 120 ml amber glass bottles, immediately placed on ice and transported to the South Carolina Department of Health and Environmental Control's Region 7 Environmental Quality Control laboratory at North Charleston, South Carolina. An additional 120 ml water sample was included with each shipment as a temperature control. At the laboratory, sample sets exceeding a 30-hour holding time or containing a temperature control in excess of 10 degrees Celsius were discarded (APHA, 1970).

Surface water temperatures were measured utilizing hand-held, laboratory-quality calibrated centigrade thermometers. Salinity measurements were measured in the laboratory using an automatic temperature compensated refractometer. Additional field data include ambient air temperature, wind direction, tidal stage and date and time of sampling. Tidal stages were determined by using Nautical Software's *Tides & Currents*, Version 2 (1996).

WATER QUALITY MONITORING RESULTS

No station exceeds a fecal coliform geometric mean MPN value of 14. No station exceeds a fecal coliform geometric mean MPN value of 88. Stations 18, 30, and 31 exceed a fecal coliform MPN estimated 90th percentile value of 43. No station exceeds an estimated 90th percentile fecal

coliform MPN value of 260. Table 2 is a summary of routine classification data for the January 1, 2003 through December 31, 2005 review period.

CONCLUSIONS

Based on review of fecal coliform bacteriological data and the pollution source survey, Area 09A is impacted by one primary source of actual or potential pollution.

NONPOINT SOURCE RUNOFF

Stormwater runoff continues to be the major source of fecal coliform bacteria throughout the area. Moderate animal populations, both domestic and wild, likely impact water quality in the area. Nearly all of the upland shoreline has waterfront residential property directly along the marsh. Development in close proximity to shellfish harvesting waters is also a likely contributor to lower water quality within the area. Overland runoff in Area 09A, however, appears to be mitigated by coastal ocean water entering the estuary through Breach Inlet.

RECOMMENDATIONS

Shellfish growing area water quality in Area 09A continues to fluctuate. Annual water quality oscillations, primarily rainfall-induced, frequently result in shifts between Approved and Restricted classifications at several Area 09A water quality monitoring stations. However, for the current three-year review period, only three of the thirty-three active shellfish monitoring stations exhibited Restricted water quality. The remaining thirty stations exhibit Approved water quality. Based upon the bacteriological water quality analysis and the shoreline pollution source survey, classification changes are recommended. The Conditionally Approved area adjacent to the Mt. Pleasant mainland is recommended for reclassification as Approved. Additionally, Sullivans Island Narrows, Lofton Creek, portions of southern Conch Creek, and portions of the AIWW between Station 36 and Station 09 (Ben Sawyer Bridge) are recommended for reclassification as Approved.

The following harvesting classifications for Area 09A are recommended:

Prohibited: (Administrative closure)

1. The AIWW, within approximately 1000 feet of the Forest Trail WWTP outfall in Shellfish Management Area 08;
2. Hamlin Creek, the full width of the creek extending approximately 1565 ft to the north and 939 feet to the south of Two Island Marina/Long Island Yacht Harbor (based upon Division of Water Quality modeling dated 03/15/2002);
3. The Cove, along Sullivan's Island, between Charleston Harbor and the Ben Sawyer Bridge (Station 09).

Restricted:

1. The AIWW, from the Forest Trail WWTP Prohibited closure (northeast of Station 18) southwest to Station 19;

2. Inlet Creek and marsh adjacent to the Mt. Pleasant mainland, landward of a line extending from the mainland northeast of Station 24 to a point approximately 700 feet south of Station 31.

Approved: All other waters of Area 09A.

Station Additions/Deactivations/Modifications:

Deactivation: 9A-12, 9A-15, 9A-21, and 9A-22

Due to their close proximity to Breach Inlet and correspondingly high rate of flushing with the ocean, the above stations have historically shown consistent Approved water quality. In order to reduce unnecessary sampling, these stations are recommended for deactivation.

Analysis of sampling data for Area 09A demonstrates the probability of a significant impact from rainfall exceeding 4.00" in a 24-hour period. Therefore, a precautionary closure of Area 09A will be implemented following rainfall events of greater than 4.00" in a 24-hour period, as measured at the Mount Pleasant Waterworks, Rifle Range Road facility located in Mount Pleasant. This methodology is associated with the concept of the Probable Maximum Precipitation (PMP). The National Weather Service publishes PMP estimates for the coastal United States in a series of hydro-meteorological reports (HMRs) (*National Weather Service*). PMP estimates for South Carolina's growing areas are derived from HMRs 51, 52, and 53 (*National Research Council, 1985*)

REFERENCES

American Public Health Association, Inc. *Procedures for the bacteriologic examination of sea water and shellfish*, 1970. p. 28-47. In *Recommended procedures for the examination of sea water and shellfish*, 4th ed. Library of Congress, Washington, D.C.

Cleveland, E. G., 1967. *Sullivans Island - Isle of Palms hydrographic study*. United States Department of Health, Education and Welfare, Public Health Service, Region IV, Atlanta GA.

National Research Council, 1985, *Safety of Dams - Flood and Earthquake Criteria* National Academy Press, Washington DC.

National Shellfish Sanitation Program (NSSP) -- *Guide for the Control of Molluscan Shellfish*, 1997 Revision. U.S. Department of Health and Human Services, Washington, D.C.

National Weather Service. The National Oceanic and Atmospheric Administration. *Precipitation Frequency Atlas of the Western US: NOAA Atlas II*. Superintendent of Documents, US Government Printing Office - Washington DC.

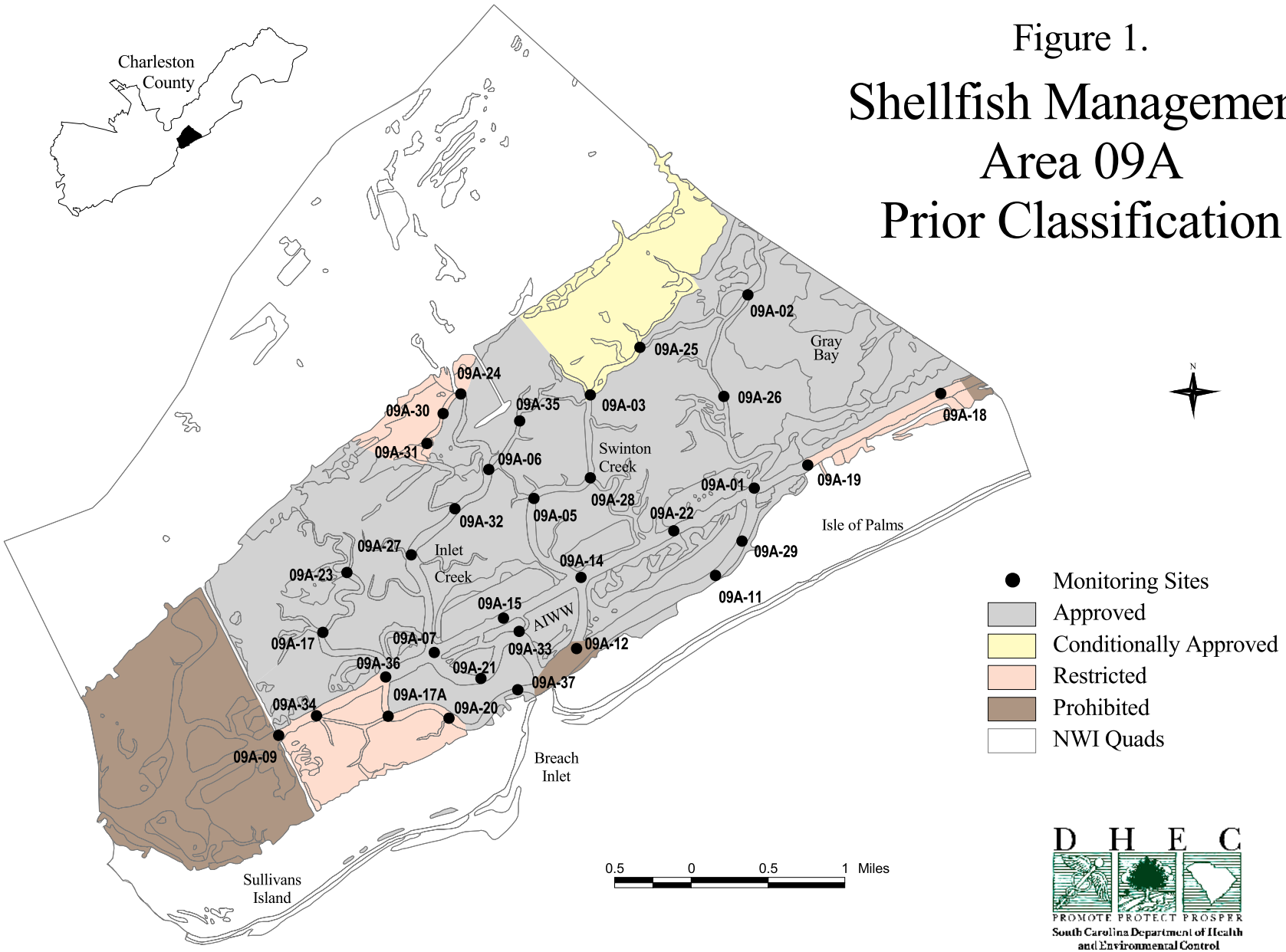
United States Department of Agriculture, Soil Conservation Service, 1971. *Soil survey of Charleston County, South Carolina*. In cooperation with South Carolina Agricultural Experiment Station and South Carolina Land Resources Conservation Commission, National Cooperative Soil Survey, Washington, D.C. p. 78.

TABLE #1
Shellfish Management Area 09A
Water Quality Sampling Stations Description

Station	Description
01	Hamlin Creek at its confluence with AIWW
02	Upper end of Hamlin Creek at POG
03	Upper end of Swinton Creek
05	Shortcut - Swinton Creek
06	Inlet Creek and Gentide Creek
07	Inlet Creek at its confluence with AIWW
09	Ben Sawyer Bridge
11	End of 10th Street at Hamlin Creek
12	Swinton Creek at its confluence with Hamlin Creek (Deactivate 01/01/07)
14	Swinton Creek at its confluence with AIWW
15	AIWW between Inlet and Swinton Creeks (Deactivate 01/01/07)
17	Conch Creek State Shellfish Ground - Mt. Pleasant side
17A	Conch Creek State Shellfish Ground - Sullivans Island side
18	AIWW adjacent to Wild Dunes Golf Course storm drainage outfall
19	AIWW at 25th Street - Isle of Palms
20	Conch Creek at Lofton Creek
21	Inlet Creek 100 yards past first bend (Deactivate 01/01/07)
22	AIWW - Marker #118 (Deactivate 01/01/07)
23	Upper reaches of Conch Creek
24	Upper reaches of Inlet Creek
25	Upper reaches of Swinton Creek
26	Hamlin Creek halfway between Stations 1 and 2
27	Inlet Creek west of AIWW at first bend
28	Swinton Creek west of AIWW at second bend
29	Lower Hamlin Creek at site of new bridge (Isle of Palms Connector)
30	Upper Inlet Creek at Jennie Creek
31	Bay at end of upper Inlet Creek
32	First creek on right downstream from station 6
33	First large creek up Inlet Creek from station 8
34	AIWW at confluence with Sullivans Island Narrows (across from ECOMC dock)
35	300 yards upstream from station 6
36	Conch Creek at its confluence with AIWW
37	Lower Conch Creek at marina closure zone

(Total 29 Active)

Figure 1.
Shellfish Management Area 09A Prior Classification



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South Carolina Department of Health and Environmental Control

Figure 2.

Shellfish Management Area 09A Current Classification

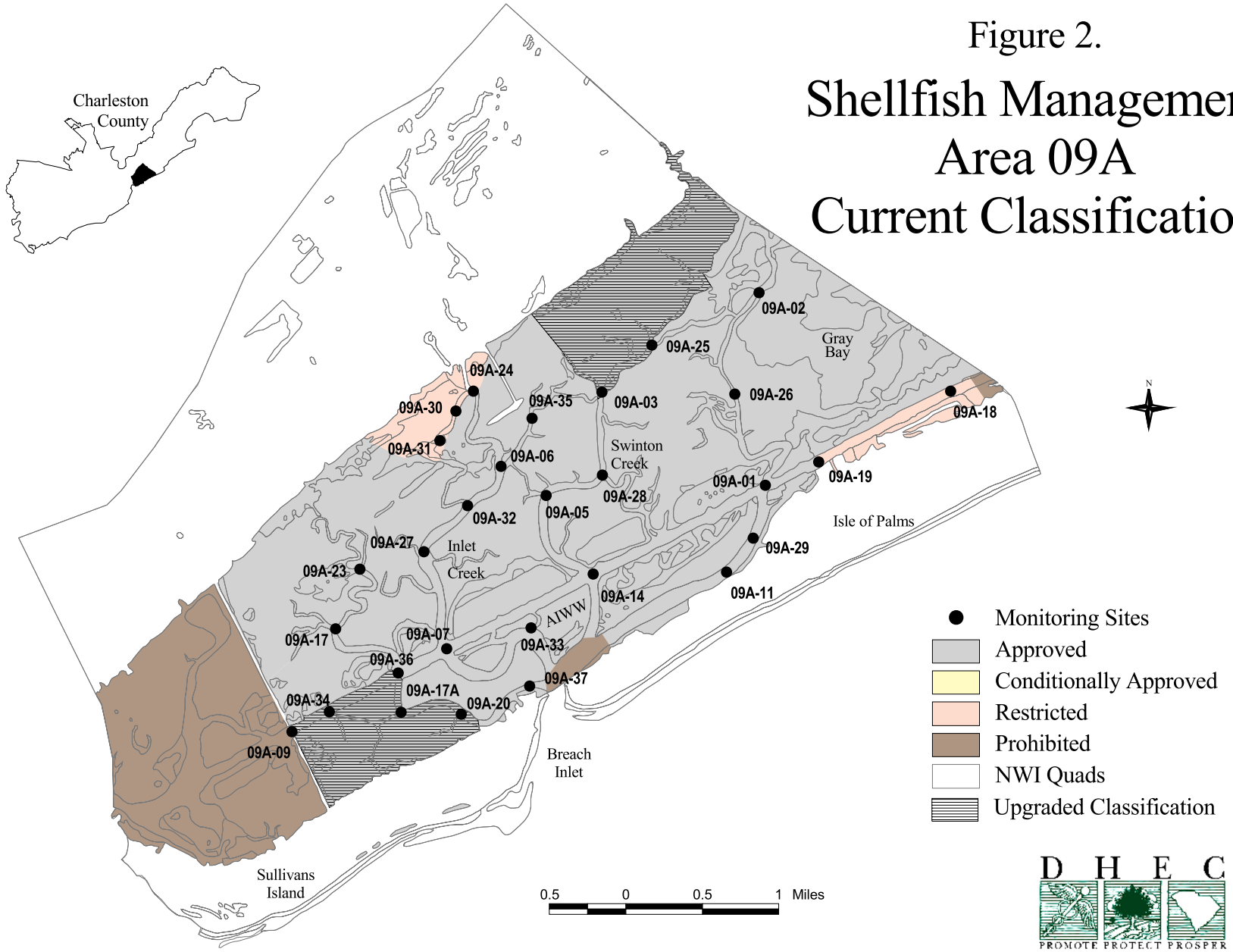

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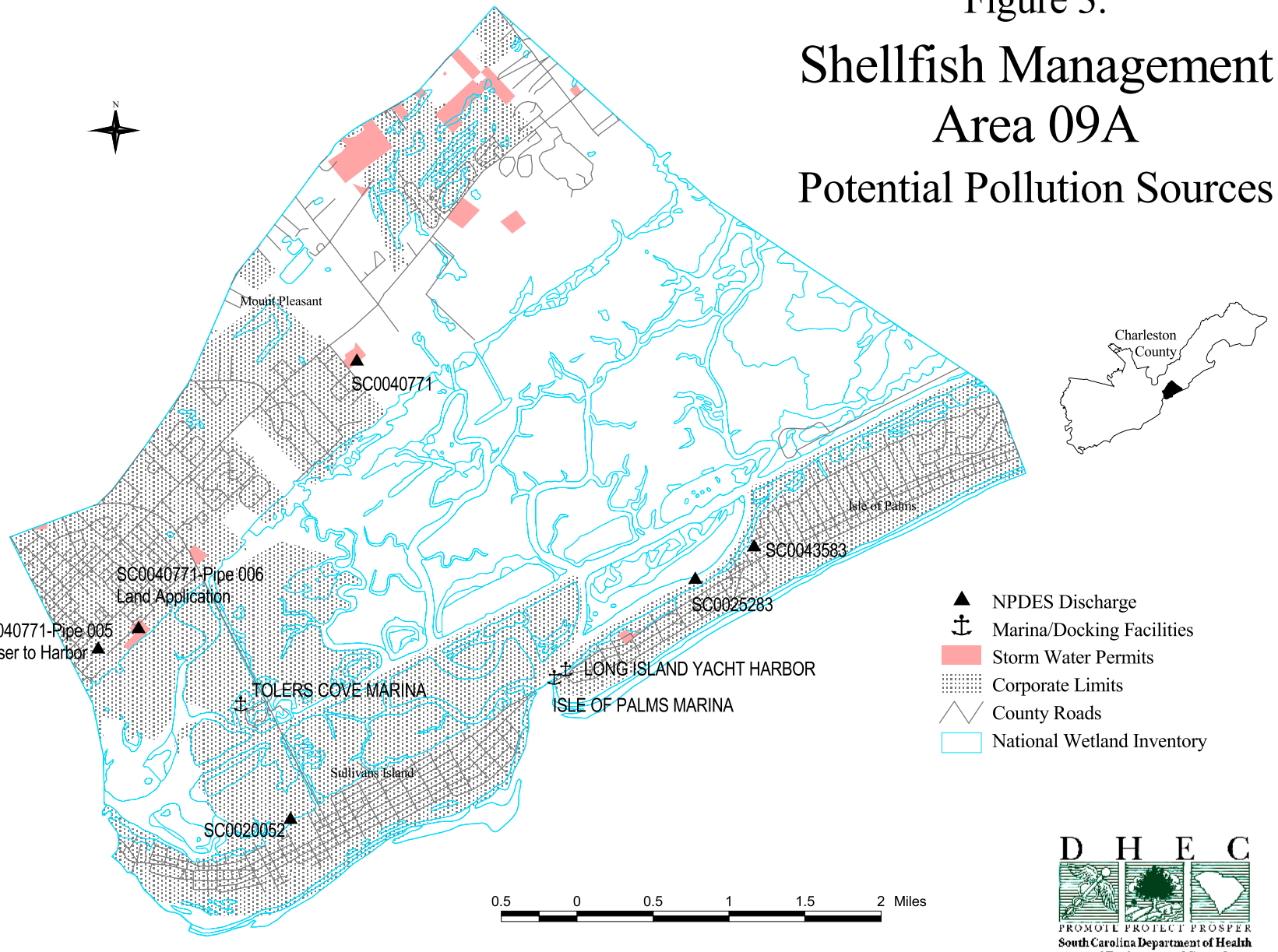
Figure 3.

Shellfish Management Area 09A

Potential Pollution Sources



- NPDES Discharge
- Marina/Docking Facilities
- Storm Water Permits
- Corporate Limits
- County Roads
- National Wetland Inventory

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TABLE #2
Shellfish Management Area 09A
FECAL COLIFORM BACTERIOLOGICAL DATA SUMMARY
from Shellfish Water Quality Sampling Stations between
January 1, 2003 and December 31, 2005

Station #▶	1	2	3	5	6	7	9	11	12	14
SAMPLES	36	36	36	36	36	36	36	36	36	36
GEOMEAN	5.2	2.6	6.4	4.3	4.5	3.7	6.9	5.9	4.1	3.9
90TH %ILE	22	6	30	13	14	11	28	24	12	11
WATER QLTY	A	A	A	A	A	A	A	A	A	A
CLASSIFICATION	A	A	A	A	A	A	P	A	P	A

Station #▶	15	17	17A	18	19	20	21	22	23	24
SAMPLES	36	36	35	36	36	36	36	36	35	36
GEOMEAN	3.6	5.2	5.8	12.6	6.8	4.2	3.3	4.0	6.6	6.5
90TH %ILE	10	15	23	113	37	12	9	14	26	25
WATER QLTY	A	A	A	R	A	A	A	A	A	A
CLASSIFICATION	A	A	A	R	R	A	A	A	A	R

Station #▶	25	26	27	28	29	30	31	32	33	34
SAMPLES	36	36	36	36	36	36	36	36	36	36
GEOMEAN	7.1	4.4	3.4	4.9	7.0	8.3	11.4	4.3	3.6	9.4
90TH %ILE	32	14	9	15	25	52	66	15	11	39
WATER QLTY	A	A	A	A	A	R	R	A	A	A
CLASSIFICATION	A	A	A	A	A	R	R	A	A	A

Station #▶	35	36	37							
SAMPLES	36	36	36							
GEOMEAN	3.6	6.4	3.7							
90TH %ILE	10	23	11							
WATER QLTY	A	A	A							
CLASSIFICATION	A	A	A							

A - Approved **CA** - Conditionally Approved **R** – Restricted
RND - Restricted/No Depuration **P** – Prohibited

TABLE #3

SHELLFISH MANAGEMENT AREA 09A

WATER QUALITY SAMPLING STATIONS DATA

Detailed data for each shellfish station listed in this report's "Fecal Coliform Bacteriological Data Summary Table" and in other shellfish reports, can be obtained through South Carolina's Department of Health and Environmental Control – Freedom of Information office at the address below.

Freedom of Information
2600 Bull Street
Columbia, SC 29201

Any explanation or clarity needed on the report's content can be obtained by contacting the preparer(s), and/or reviewer(s) listed on the cover page.

TABLE #4

RAINFALL DATA

Shellfish Management Area 09A

SOURCE:
Rainfall information provided by
Mount Pleasant Waterworks & Sewer Commission
Mount Pleasant, South Carolina.
[Rifle Range Road rainfall recording station]

AREA 9A ANNUAL TABLE OF DAILY RAINFALL DATA

SOURCE: Mt. Pleasant Waterworks and Sewer Commission

Mt. Pleasant, SC (Rifle Range Road rainfall recording station)

2003	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1st	1.00		0.50									
2nd					0.20		0.40		0.50			
3rd							0.50					
4th			0.10			**0.60**			0.10			0.50
5th						0.10		0.50				1.10
6th			1.00						4.80			
7th		0.70	0.50		1.10	0.30		1.00	1.60			
8th				1.00		0.70			**0.20**	0.50		
9th				2.70		0.20			0.40			
10th		0.20		0.50								
11th		0.20		0.10								0.90
12th												
13th			0.30									
14th			0.60				1.60					0.50
15th			0.20			0.20	1.50					**0.20**
16th					0.70							
17th		0.90	1.30		0.30							
18th					0.40		0.10				0.30	
19th					1.20	0.40	0.30	1.30			0.20	
20th			1.70				0.90					
21st												
22th	0.50			0.10								
23rd	0.30	0.70			2.80		0.40		0.20			
24th							1.90					
25th												
26th				1.90			1.60					
27th		0.60		0.20			0.30					
28th		0.30			0.50		0.10			0.50	0.00	
29th						0.50	0.90			1.80		
30th												
31st												

(Monthly Figures) **Year's Rainfall Total:** **55.90**

SUM	1.80	3.60	6.20	6.50	7.20	3.00	10.50	2.80	7.80	2.80	0.50	3.20
MAX	1.00	0.90	1.70	2.70	2.80	0.70	1.90	1.30	4.80	1.80	0.30	1.10
MIN	0.30	0.20	0.10	0.10	0.20	0.10	0.10	0.50	0.10	0.50	0.00	0.20
AVG	0.60	0.51	0.69	0.93	0.90	0.38	0.81	0.93	1.11	0.93	0.17	0.64

"ND"/"--" = no data (Shaded/bold entries are the dates shellfish water samples were taken.) 8,9a,9b

AREA 9A ANNUAL TABLE OF DAILY RAINFALL DATA

SOURCE: Mt. Pleasant Waterworks and Sewer Commission

Mt. Pleasant, SC (Rifle Range Road rainfall recording station)

2004	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1st					1.30		0.30					
2nd		1.50			1.00		0.50			1.60		
3rd		0.30			0.30							
4th												
5th									0.50			
6th									1.70			
7th									0.40			
8th				0.30					0.30			0.10
9th										0.60		
10th	0.20											0.40
11th	0.50	0.70		1.10			0.20		0.20			
12th		0.10		0.10				2.50	0.10		0.10	
13th		0.10		0.10				3.50	1.00			
14th		0.30						1.50		0.40		
15th			0.30			0.10		0.60		0.50		
16th		0.30				0.20						
17th					0.50	0.50		**0.30**				
18th							0.10					
19th						0.40	0.80					
20th												
21st												
22th								0.30				
23rd												
24th											0.10	
25th								0.10				1.00
26th		0.70						0.30	3.50			0.20
27th	0.70					0.40		1.30	0.50		1.00	
28th							3.10	4.00				
29th							0.20	4.00				
30th			0.10	1.60		0.70		0.10	0.50			
31st												

(Monthly Figures) **Year's Rainfall Total:** **52.80**

SUM	1.40	4.00	0.40	3.20	3.10	2.30	5.20	18.50	8.70	3.10	1.20	1.70
MAX	0.70	1.50	0.30	1.60	1.30	0.70	3.10	4.00	3.50	1.60	1.00	1.00
MIN	0.20	0.10	0.10	0.10	0.30	0.10	0.10	0.10	0.10	0.40	0.10	0.10
AVG	0.47	0.50	0.20	0.64	0.78	0.38	0.74	1.54	0.87	0.78	0.40	0.43

"ND"/"--" = no data (Shaded/bold entries are the dates shellfish water samples were taken.) 8,9a,9b

AREA 9A ANNUAL TABLE OF DAILY RAINFALL DATA

SOURCE: Mt. Pleasant Waterworks and Sewer Commission

Mt. Pleasant, SC (Rifle Range Road rainfall recording station)

2005	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1st				1.50		0.50	0.70	0.10		0.50		
2nd		0.10		0.10								
3rd		0.70				0.40	0.40					
4th					0.30					0.40		0.30
5th					1.10	0.50		0.20		2.00		1.00
6th								2.00	0.50	3.00		
7th			0.50	0.20						0.70		
8th							0.30	1.30				1.00
9th		0.50					0.40	0.40		0.50		
10th							0.20					
11th								0.70		0.20		
12th	0.30			0.20				0.40				
13th	0.50			0.20			0.10		0.20			
14th	0.10											
15th			0.50					0.50				0.20
16th			1.20									
17th			0.10		0.70			2.50				1.00
18th					1.50							
19th						0.40						
20th					2.00						6.00	
21st		0.70										
22th			3.00	0.10				1.00				
23rd		0.20				0.40		0.50		1.00		
24th		0.10				0.10		0.50	0.50	**0.50**		0.10
25th			0.10			1.20		0.50				
26th			0.50					0.50				
27th		1.30	2.50			0.20		0.70	1.50	0.10	0.20	
28th					0.20	0.40			1.25		0.50	0.10
29th					1.50	0.30	0.30				0.70	
30th	0.60				0.30			0.10				
31st					1.20		0.20					

(Monthly Figures) **Year's Rainfall Total:** **67.45**

SUM	1.50	3.60	8.40	2.30	8.80	4.40	2.60	11.90	3.95	8.90	7.40	3.70
MAX	0.60	1.30	3.00	1.50	2.00	1.20	0.70	2.50	1.50	3.00	6.00	1.00
MIN	0.10	0.10	0.10	0.10	0.20	0.10	0.10	0.10	0.20	0.10	0.20	0.10
AVG	0.38	0.51	1.05	0.38	0.98	0.44	0.33	0.74	0.79	0.89	1.85	0.53

"ND"/"--" = no data (Shaded/bold entries are the dates shellfish water samples were taken.) 8,9a,9b